

TECH-TOPICS

Reporting On the Advance Application of Switches, Jacks, Plugs, Molded Cable Assemblies & Audio Connectors

5555 ELSTON AVENUE **SWITCHCRAFT** CHICAGO, ILLINOIS 60630

AMC Waveform Analyzer Illustrates Good Use Of Non-illuminated Pushbutton Switches

When there is the design-need for a compact pushbutton switch that combines the economy of a non-illuminated switch with the legend indication visibility usually found only in an illuminated type, the Switchcraft littel "Multi-Switch" Series 36000 is an ideal choice.

An interesting and typical application of the Series 36000 "Multi-Switch" is its use in the new Model 1000 Digital Waveform Analyzer produced by the Automated Measurements Corporation, of Los Gatos, California.

AMC describes the Model 1000 as "the first

digital measuring instrument to provide measurement rates compatible with computer-controlled system speeds and the first to significantly advance the state-of-the-art in digital waveform measurement techniques."

Included in the many new performance features of the Model 1000 are: (1) Remote programming of all digital measurement functions. (2) Up to 10 programmable signal inputs. (3) Up to 200 complete measurements per second. (4) Self-contained program logic. (5) Simple serial-by-character alpha-numeric program language. (6) Compatibility with most program storage devices. (7) 500 KHz character rate—equivalent to 3.5 MHz bit rate. (8) Dual-trace analog display with automatic measurement reference marks. (9) Single measurement selection capability. (10) Four-digit front panel readout with automatic range, polarity, and decimal point indication. (11) BCD coded outputs supplied for data logging equipment. (12) Self-contained amplitude and time calibration indication on all ranges. (13) One percent steps in measurements of waveform percentage and voltage with respect to ground or a pre-programmed reference level. (14) Built-in differential voltmeter with front panel external input. (15) Up to 10 remotely programmable, high impedance, sampling probes. (16) Real-time sampling sweep ranges from 10 milliseconds full-scale to one second full-scale. (17) Optional front or rear panel signal inputs.

Another important performance feature of the Model 1000 is front panel control of all digital measurement functions by digiswitch and pushbutton switches. It is for the pushbutton control section that AMC design engineers chose Series 36000 non-illuminated "Multi-Switch" assemblies fitted with engraved display screens.

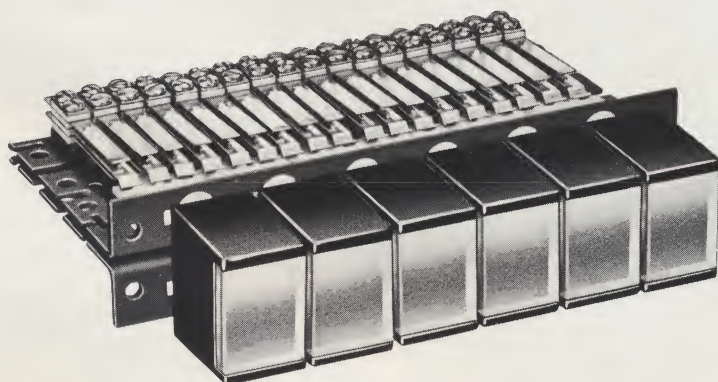
The pushbutton control section consists of two, 11-station assemblies mounted in parallel rows. In its use of the Series 36000 switches, AMC made good use of the variety of operating functions offered by this versatile series.

Stations "1" through "7" are interlocked but independent of all other stations. Stations "8" and "9" are both push-to-lock, push-to-release, while stations "10" and "11" are again interlocked but independent of all other stations. Other standard functions available in the Series 36000 are non-lock and all-lock. If none of these standard functions serve a particular design requirement, the switch may be ordered with several special operating functions.

For complete information on the special operating functions and other Series 36000 "Multi-Switch" specifications, request Catalog No. S-323.



Automated Measurements Corporation Model 1000 Digital Waveform Analyzer. Series 36000 littel "Multi-Switch" assemblies are pushbuttons mounted on right side of attractive control panel. This compact, but versatile switch is ideal for applications requiring maximum legend visibility in a non-illuminated pushbutton switch.



Typical Series 36000 littel "Multi-Switch" assembly showing sturdy frame and compact design of "Tini-Stack" stack switches, which make up behind-panel portion of assembly. Stack switch springs are made of special alloy of spring tempered nickel silver. Molded nylon lifters provide easier action, longer spring life.

3-color Switch Simplifies Control Of Audio Equipment In Travelling Language Laboratory

Many school districts have the problem of a few slow learners scattered among several elementary schools (public & private) throughout the district. To periodically bus these children to a central classroom for diagnostic and remedial help has not been practical. Also, because of the bulk of teaching aids and equipment required by the specialist teacher, it is not reasonable to expect the specialist to move about the district with any degree of efficiency.

MOBILAB, developed by Audio Engineering Co., New London, N. H., solves the problem.

Attached to the instructor's car, it may be quickly and easily moved from school to school on a pre-determined schedule. It is equipped with all of the necessary furniture and audio-visual equipment to render complete individual and small group instruction.

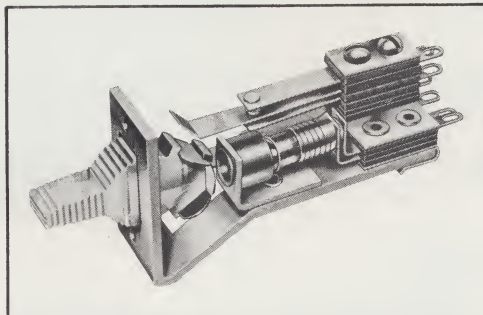
Within the design of the control console regulating the tape-record reproduce equipment used in the MOBILAB language laboratory, is an interesting application of Switchcraft's unique Series 25000 3-color illuminated lever switch that may have application to many other switching design problems.

In a MOBILAB language laboratory, a teacher faces a control panel and each pupil is located in a booth with a glass front and acoustically silenced sides.

Each student may be provided with a tape recorder-reproducer and he wears a microphone and earphones. The teacher has a tape reproducer at her console, which she can connect to any selected earphones and tape machine of the students. The teacher normally has available a group of tape reproducers, each

containing different materials, and instructs a group of students, to whom the materials are selectively routed.

The material routed to a student is recorded at his recorder, on one track, and he can record his own answers or pronunciation or the like on another track, of the tape machine. The teacher may selectively listen to the students, or communicate with them.



"Lever-Lite" Series 25000 3-color illuminated switch.

In the past the required selective interconnection of students and teacher has been accomplished by means of a multiple position rotary switch for each student. This has proven expensive to install and confusing to operate.

As a solution to this problem, the rotary switches were eliminated and replaced with Series 25000, color coded switches at both the teacher's position, for each tape recorder-reproducer, and for each pupil's position.

The unique design of the Series 25000 switches provides different colored illumination at each of the switch's three positions.

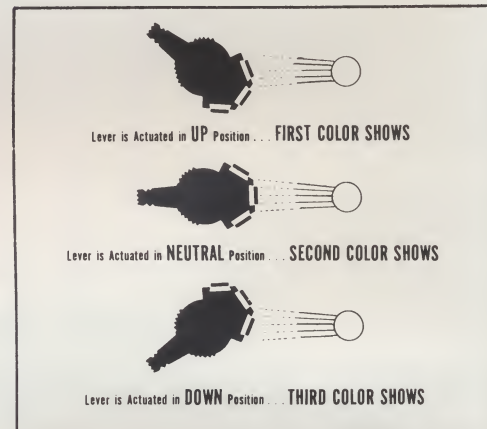
In this way, teachers have full visual knowledge of the status interconnections of the system and can readily perform switching operations with minimum error.

Through the use of the Series 25000 "Lever-Lite" switches in this and other applications, it is possible to substitute one switch and one lamp for one switch and up to three separate indicator lamps.

The result is reduced panel space requirements and minimum wiring and other installation costs.

The Series 25000 is unusually small and requires slightly more than one inch of panel space and only 2¼" depth behind the panel. It is available in 2 and 3 position models and in locking and non-locking types. Individual color chips mounted on the rear portion of the switch lever are moved into position to reflect light from a lamp mounted in the switch as the lever is moved into its different positions. The color illumination is then projected to the translucent lever. The lever is serrated to add dimensional visibility for greater operator reaction.

Six standard filter colors—blue, red, amber, yellow, green and white are available.



Here is how Series 25000 switch works. (1) Lever is actuated in UP position—first color shows. (2) Lever is actuated in NEUTRAL position—second color shows. (3) Lever is actuated in DOWN position—third color shows.

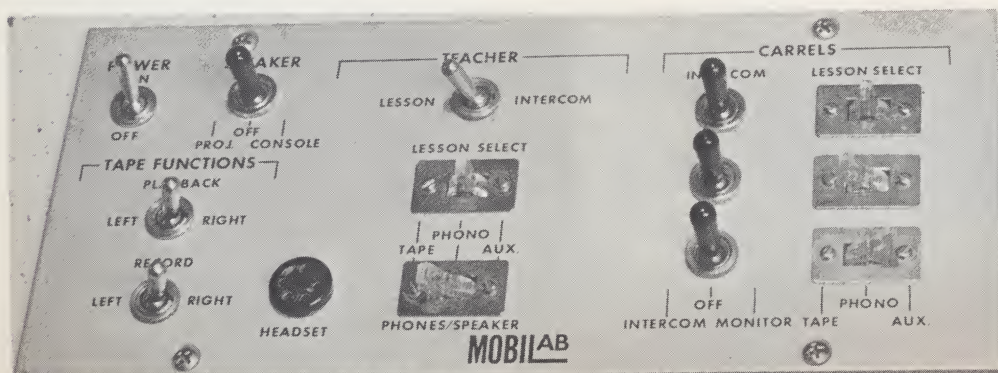
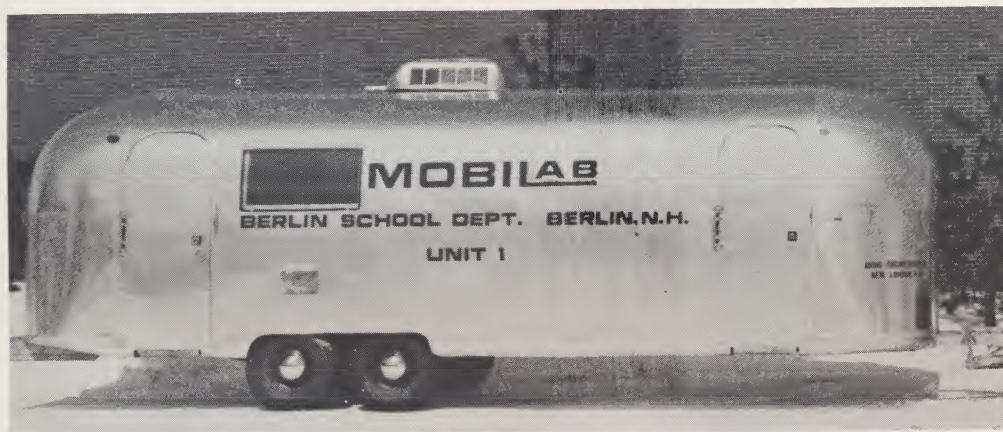
For complete information on the Series 25000 "Lever-Lite" switches, including all basic contact forms available, request Catalog S-307.

PRODUCT APPLICATIONS

In this, the second year of issue of Tech-Topics, we would like to invite you to continue sending in any suggestions or ideas for articles. Any system—using Switchcraft components—which you may have designed, installed or may have heard about, would be of interest to Tech-Topics readers.

The field of switches, plugs and connectors has often been neglected as far as product applications are concerned—a communications lack we hope to correct through the pages of Tech-Topics. A glance through this issue will give you some idea of the diverse applications we like to present to our readers.

We hope you enjoy reading Tech-Topics and should you know of other people within your organization who would be interested, please send us their names and addresses. We will be pleased to add them to our ever-growing mailing list. The address for all correspondence is: Tech-Topics, Switchcraft, Inc., 5555 North Elston Avenue, Chicago, Illinois 60630.



Typical tape record-reproduce control console installed in MOBILAB for language laboratory control. Series 25000 "Lever-Lite" switches can be seen in center and right side of control panel. Lesson Select switch in center, for example, is 3-position model. Translucent lever glows with different color in each of "tape," "phono" or "aux" positions.

Speaker and intercom lever switches with black knobs, incidentally, are 3-position "Lev-R" switches Series 3000 also manufactured by Switchcraft.

COMPACT DESIGN OF SERIES 37000 "MULTI-SWITCH" FITS PLUG-IN SWITCH MODULE FOR CONTROL PANEL

Super-Trol II is the latest addition to a distinguished line of supervisory control systems designed and manufactured by Control Corporation, a division of Control Data Corporation, Minneapolis, Minn. Since its beginnings, thirty years ago, Control Corporation has placed in the field over 3,500 systems for controlling electric utilities, oil and gas transmission, water and sewage plants, and numerous industrial processes. Drawing on this reservoir of experience, Control Corporation engineers have incorporated into Super-Trol II the most reliable techniques yet devised for ensuring extremely fast, error-free operation, including solid-state logic and automatic address verification.

Super-Trol II operates over common communications lines such as telephone or microwave, exchanging control signals and data between a central master station and one or many remote stations by means of coded audio tones. On duty twenty-four hours a day, solid-state Super-Trol II is a tireless, supremely accurate servant designed to provide any or all of the following:

- control and supervision of remote equipment, with continuous scanning of all points
- acquisition of analog and digital data from remote locations

- logging of remote and local data, both analog and digital
- reading of telemetric measurements

When the operator wishes to effect a change at a specific remote point, he operates the appropriate switch on the Super-Trol II control panel and selects the point by pressing the associated button. This causes the normal alarm scan to be interrupted.

The address of the remote point is decoded, translated into a digital address by the digital data converter, and transmitted to the remote station.

At the remote station the point is selected and the address is stored and transmitted back to the master station along with the present operational status of the device being addressed.

The master station compares the received address with the original encoded address from the control panel.

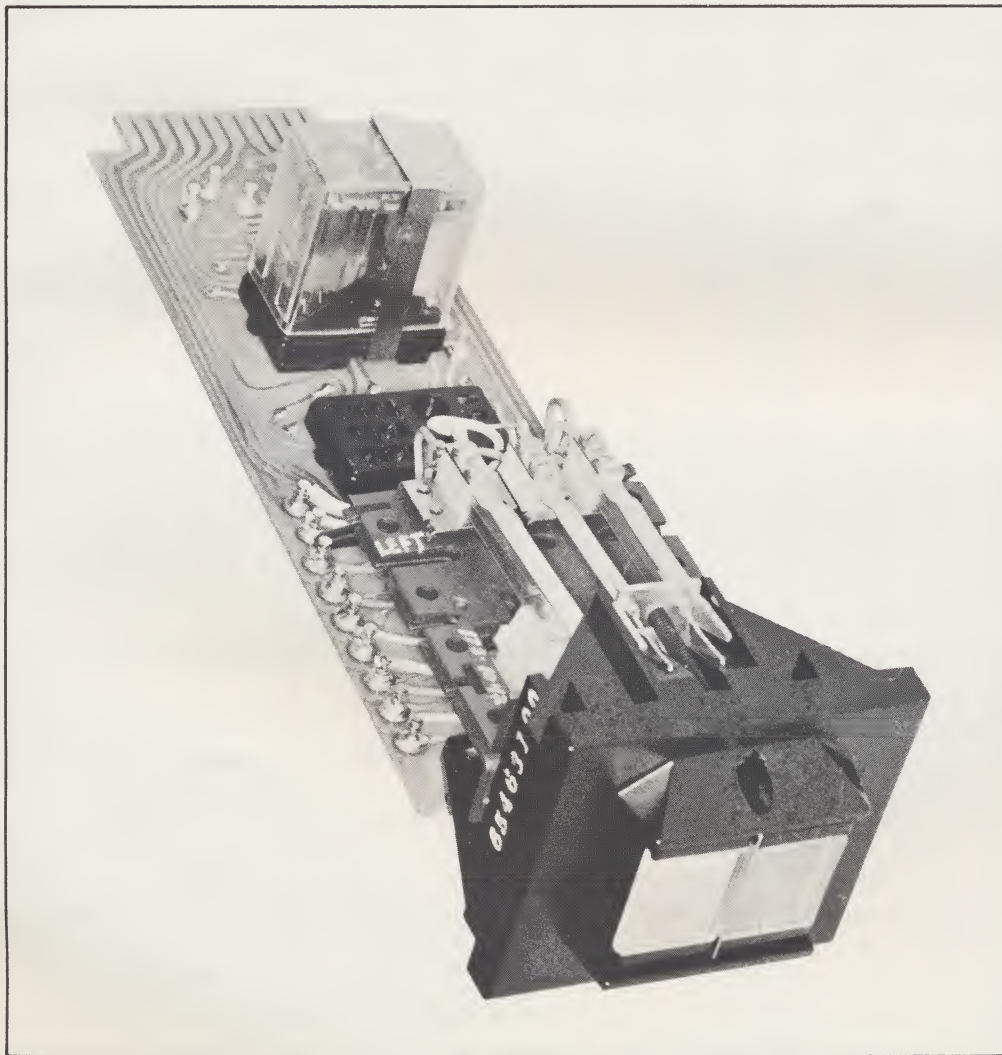
If the comparison agrees and other error checks are passed, the master station automatically retransmits the command address to the remote station. Here the address is compared with the stored address on a bit-for-bit basis, and if the two addresses agree, the selected interposing relay is actuated which operates the remote device.

The new status of the device is then transmitted to the operating console and displayed.

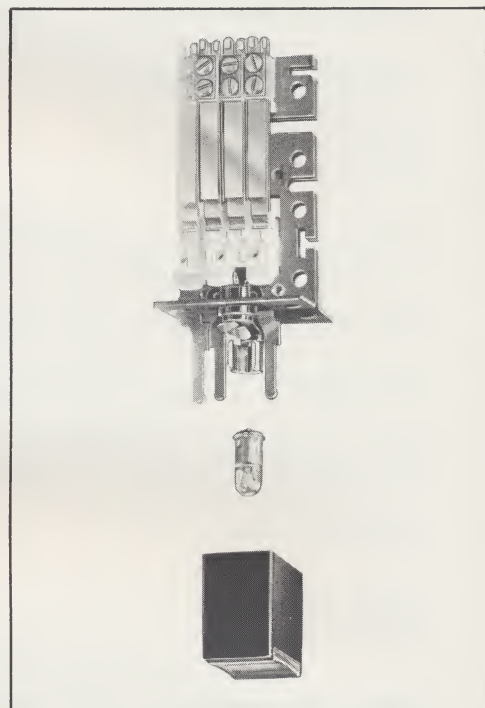
A unique design feature of the control panel is the use of Switchcraft Series 37000 illuminated little "Multi-Switch" units mounted in plug-in escutcheons. This module construction reduces control panel size, simplifies additions and reduces maintenance.

The Series 37000 is ideal for all pushbutton switch applications where minimum space is available. In most cases, any assembly of Series 37000 switches will require only half the panel space of other pushbutton switches with similar capabilities.

Another feature of the Series 37000, which made it particularly adaptable to use in the Super-Trol II plug-in escutcheons, is the fact that indicator light and switching function is combined in a single compact unit. Each pushbutton station has its own built-in lamp, so there is no need for costly wiring of separate panel lights to indicate switch status.



Unique plug-in escutcheon used in master control panel of new Super-Trol II Supervisory Control System. Pushbutton switch used is Series 37000 illuminated little "Multi-Switch." Compact design of switch and module reduces control panel size, simplifies additions and reduces maintenance.



Lamps used in illuminated pushbutton switches do burn out. But when this happens with a Series 37000 "Multi-Switch" used in the Super-Trol II Control Panel, lamp replacement can be accomplished quickly and easily from front of panel without use of special tools and without damage to wiring. The pushbutton is simply pulled off its slide mounting. Push on the lamp and it pops out of its spring clip. A new lamp may then be inserted and the pushbutton replaced.

For additional information on the many advantages of the little "Multi-Switch" Series 37000, request Switchcraft Catalog No. S-323.

**TURN PAGE FOR COMPLETE
LEVER SWITCH
REFERENCE GUIDE**

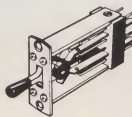
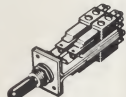
LEVER SWITCH SPECIFYING GUIDE

To meet the requirements of increasingly complex electrical/electronic equipment, Switchcraft has engineered a wide variety of versatile lever switches.

This Lever Switch Specifying Guide identifies all standard Switchcraft lever switches by series name, number and important switch characteristics. By noting switch characteristics suitable to your requirements and referring to this chart, Switchcraft lever switches suited to your particular application can be readily identified.

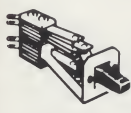
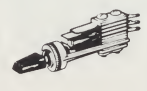
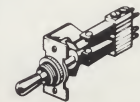
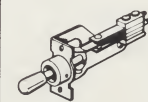
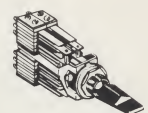
How to Use the Chart

1. Columns with a dash indicates data under that particular column does not apply.

LEVER SWITCHES	LEV-R SWITCH	TELEVER SWITCH	LO-CAP SWITCH	LEV-R SWITCH	LEV-R SWITCH	TELEVER SWITCH
						
SERIES NUMBER	3000	6000*	10000	12000	13000	16000*
STATIONS PER ASSEMBLY	1	1	1	1	1	1
SWITCH FUNCTIONS: Locking(L), Non-Lock (NL), Talk-Listen (T)★	L, NL & T	L & NL	L & NL	L, NL & T	L, NL & T	L & NL
NUMBER OF POSITIONS	2 or 3	2 or 3	2 or 3	2 or 3	2 or 3	2 or 3
MAX. A.C. AMPS, non-inductive load	3	3	1	3	3	3
MAX. WATTS, A.C., non-inductive load	300	300	100	300	300	300
MAX. POLES PER SWITCH FRAME	to 3	to 4	to 8	to 2	to 3	to 8
CONTACT FORMS	A to D	A, C & D	A to C	A to D	A to D	A to D
KNOB: Illuminated (I), Colors (C), Red (R), Black (B)	B	B	B	B	B	B
KNOB TYPE: Tear Drop (T), Contour (C), Spatula (S), Paddle (P)	T	T	T	T	T	T
MOUNTING: Screw (S), Bushing (B)	B	S	S	B	B	B
MOUNTING HOLE DIA.	1/2"	—	—	1/2"	1/2"	1/2"
MOUNTING CENTERS	2 1/32"	7/8" #	7/8"	1 15/16"	2 1/32"	7/8"
DEPTH BEHIND PANELS (Including Terminals)	2 19/64"	3"	3 7/16"	7/8"	2 19/64"	3 1/32"
TERMINATIONS: Solder Lug (S), Wrap Type (W)	S	S	W	S	S	S
For complete technical specifications refer to Catalog No.	S-302a	S-302a	S-302a	S-302a	S-302a	S-302a

- List those basic characteristics you know the switch must have.
- Ascertain from the chart which Switchcraft lever switches meet the requirements of your application. For example you require a three position inter-communication "talk-listen" switch (lever locks on one side of center and operates non-locking on the other side) with form "A" contacts. Based on these parameters alone, any of five series lever switches (Series 3000, 12000, 13000, 29000 and 31000) are suited to your application. Requirements may be further defined by applying other known requirements such as screw or bushing mounting, depth behind panel and other characteristics listed on the chart.
- When you have narrowed your selection to the switch or switches which meet your requirements, send for detailed Engineering Specification Catalog(s) indicated in the "catalog" column. Circle appropriate catalog numbers on the enclosed postal card or write to Switchcraft, Inc., 5555 North Elston Avenue, Chicago, Illinois 60630, and ask for the desired catalogs.

NOTE: Only standard lever switches are listed on this chart. We invite your inquiries concerning custom lever switches designed specifically to meet your application.

LK SWITCH	MLK SWITCH	LEVER LITE SWITCH	LEVER-LOCK SWITCH	LEVER LITE SWITCH	LEV-R SWITCH	FEATHER LEVER SWITCH	FEATHER LEVER SWITCH	LT SWITCH
								
23000	MLK	25000	26000	27000	28000	29000	31000	41000
1	6 or 12	1	1	1	1	1	1	1
L & NL	L & NL	L & NL	L†	L & NL	L & NL	L, NL & T	L, NL & T	L & NL
2 or 3	2 or 3	2 or 3	2 or 3	2 or 3	2 or 3	2 or 3	2 or 3	2 or 3
3	3	3	3	3	3	2	2	3
300	300	300	300	300	300	200	200	300
to 2	to 2	to 3	to 4	to 4	to 2	to 2	to 2	to 4
A & C	A & C	A & C	A, C & D	C	A & C	A & C	A & C	A & C
B	B	I, C	R	I, C	B	C	C	B
S	S	C	T	C	C	T	T	P
S	S	S	S	S	B	B	S	B
—	—	—	—	—	15/32"	5/16"	—	15/32"
3/4"	3/4"	5/8"	7/8"	3/4"	5/8" √	7/16"	7/16"	23/32"
2 3/32"	1 15/16"	2 1/4"	3"	2 3/16"	2 17/64"	1 3/4"	1 3/4"	2 1/8"
S	S	S	S	S	S	S	S	S
S-307	S-307	S-307	S-302a	S-309	S-309	S-309	S-309	164

ease
ing, 23/32" with lock ring.

Mounts on 31/32" centers when used with number 530 escutcheon plate.

Performance And Reliability Of Plugs & Jacks Dependent Upon Material, Design, Fabrication

The factors which determine the performance, reliability and life of phone jacks and plugs are not detectable by casual visual examination of these components. Rather one must learn about the thought and care behind each of three major considerations: 1) Material Selection, 2) Structural Design, and 3) Fabrication Technique.

Let's examine the constituent elements of high performance jacks and plugs, such as the Switchcraft units shown in Figs. 1, 2 and 3, and see how materials, structure and fabrication are utilized to achieve reliability.

Contacts

Surface contamination of contacts is a major threat to reliable performance. This contamination may take the form of an extremely thin insulating film, perhaps only molecules thick, formed by airborne particles and gases.

Two different types of contacts are made when a typical plug is inserted into a jack. Refer to the cross-sectional drawings of Figs. 4 and 5. First, the plug tip encounters the tip spring. Movement of the tip spring causes the lifter to move a leaf spring into contact with another leaf. Of course, a stack of such springs may be actuated to make and break many circuits.

The tip spring serves two other purposes. It presses against the tapered section of the plug tip to hold it in place mechanically, and it functions as the electrical contact. The strong pressure and long wipe of the tip spring on the brass plug tip breaks through any film contamination to make good contact.

During machining of the plug tip, extremely close tolerances must be maintained to assure proper fit in the jack bushing and uniform contact pressure. It should be noted that a one-piece tip rod is used in the plugs shown here instead of the less dependable arrangement of having the tip screwed on to a threaded shank.

Leaf spring contacts in the jack have lower pressure and less wiping action than the tip spring. Therefore, the selection of the best contact metal in terms of contamination becomes a vital concern. It is important to match the contact metal to the application. Silver, the most economical of the noble metals, is satisfactory when used in circuits with sufficiently high current and voltage to break through any film barrier. Silver contacts are frequently suitable for wetted circuits (d-c "breakthrough voltage" added to a-c signals).

However, silver has its limitations, particularly in very low voltage circuits. Since it has a shelf life, it may perform well in a test and then prove unsatisfactory some time later when a film barrier has built up. This is especially true in "dry" circuits and in the presence of sulphur contaminants.

The jack manufacturer's object is to use a metal which will not only exceed mil spec requirements initially, but retain such performance over a long period of time. The Switchcraft jacks pictured here employ palladium leaf spring contacts. Palladium is an element of the platinum group, though harder and more fusible than platinum. Most important, palladium is highly resistant to surface contamination and may be used in wet or dry circuits, making it the best choice for both military and high performance industrial applications.

The palladium contacts in the jacks shown here are wedge shaped, and opposing contacts are mounted at right angles. The vertical cantilever

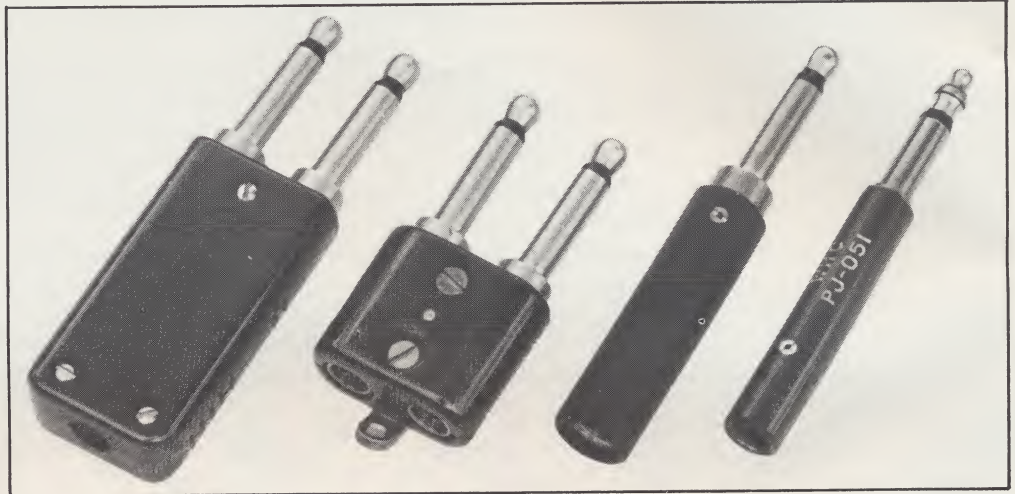


Fig. 1—The phone plugs here, designed in accordance with NME specification MIL-P-642A, feature high reliability, one-piece tip rod design instead of less dependable tip screw-to-threaded shank construction.

lever movement of the leaf spring produces a small but significant horizontal wiping action.

The merit in using palladium is indicated by the fact that an average contact resistance of only 0.005 ohm is achieved, which is four times better than that required by MIL-J-641B. Part of the reason for such low contact resistance is that the palladium contacts are crossbar welded to the leaf. Furthermore, bond strength uniformity is more reliably controlled on welded contacts than riveted attachments.

A more inert contact material than palladium, one with the highest resistance to contamination, is a special gold alloy. However, this material is not only more costly than palladium, it is also softer and therefore more subject to mechanical deformation. With nickel backing, gold contacts may be welded to leaf springs.

Springs

Leaf springs must be hard enough not to take an undesired set, yet be soft enough to be formed without fracturing. These springs should have adequate conductivity and be subject to minimal contamination. Forming and positioning these springs under tight tolerances is necessary since leaf contacts may be only a couple hundredths of an inch apart—and must remain that distance for the life of the jack.

Two desirable metals are beryllium copper and nickel silver. For severely formed shapes such as the heavy tip ring in Fig. 5, beryllium copper must be formed in a soft state, and then undergo the extra step of heat treatment to achieve proper hardening. Beryllium copper is also more inclined to tarnish than nickel silver.

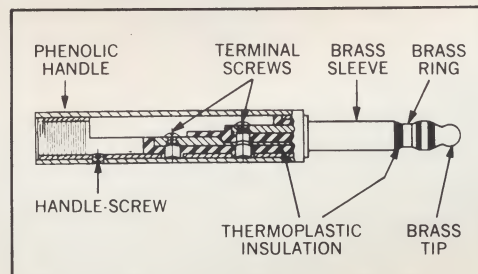


Fig. 4—Cross-section shows phone plug's basic construction. Tip rod and sleeve are assembled together to provide continuous thermoplastic insulation between plug elements.

There are a number of different nickel silvers, each containing different amounts of alloy metals. There is no silver in nickel silver. Copper content may range from 55% to 65%, zinc from 17% to 31%, manganese is about 0.5%, and nickel from 10% to 18%. High nickel content is the key factor in attaining the most suitable alloy for jack springs. The higher the nickel content, the higher the price and the better the performance.

The Switchcraft jacks in the accompanying photos use 18% nickel silver, which is silver-white in color. The metal is very malleable when annealed, and tends to work harden, strengthening its shape retention when formed. Mechanical spring life depends much on the finish and shape of the mating plug. A jack such as that pictured here would have a minimum life of 25,000 insertion and withdrawal cycles, generally much more. This is a sizeable margin over any normal life expectancy or mil specs which call for 5,000 cycles.

Frame and Bushing

The jack and frame structure is made of steel, cadmium plated and chromate treated for 100-hour salt spray test. The only significant choice a switch maker has is whether to use cold rolled steel strip such as is used in the units in Figs. 2 and 3, or less costly sheet steel. Strip is produced within a 2 or 3 mil tolerance, while sheet steel is usually within 5 mils.

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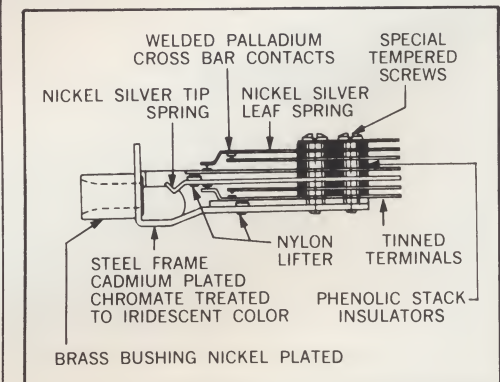


Fig. 5—For highest reliability, jack component material must be chosen carefully. Using high nickel content leaf springs, for example, contributes to a long insert-withdraw life of 25,000 cycles.

(Continued from page 6)

The bushing staked to the frame is machined of brass. Precise control of the inside diameter and contour shape, plus nickel plating thickness, is required to obtain proper mating with the plug. If too tight it will bind; if too loose it makes a sloppy fit.

Insulation

The lifters mounted in the jack springs are made of an insulating material. They must be dimensionally stable and capable of being fabricated to tight tolerances lest they fail to lift the next spring contact the correct distance. Phenolic lifters machined to ± 5 mils are satisfactory. However, molded materials such as Zytel 101 nylon used in the jacks shown may be formed to ± 2 mils.

In the insulation stack, contact springs are held firmly in place by tempered screws passing through the stack to the frame. Nylon could be used in the stack except for one drawback. Nylon under great pressure tends to take a set, requiring that the stack screws be tightened periodically. A special XXXP paper base phenolic, humidity resistant and anti-fungicidal, is a very suitable material.

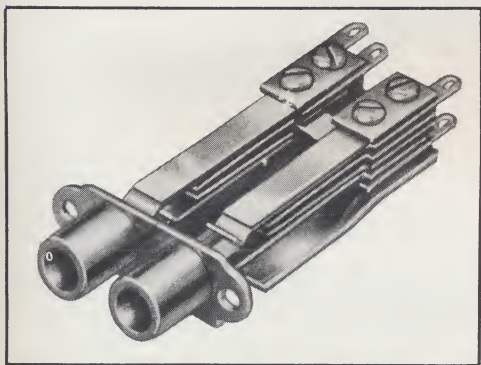


Fig. 3—Except for having two jacks on one frame, the twin jack is similar in design to jack illustrated in Fig. 2.

Incidentally, a notable feature of the stack in Figs. 2 and 3 is the fact that the phenolic insulating tube through which the screw passes is force fitted into the stack. This holds the stack together if it must be removed from the frame.

The insulation in phone plugs to separate the tip from the body is ethyl cellulose thermoplastic. Not only must the tip rod be accurately positioned in the sleeve, but insulation purity must be assured. Care during manufacture is needed so that the injected insulation does not pick up any tiny brass shavings.

These low voltage devices are checked out at 500 volts between insulated terminals, which is the voltage requirement of applicable mil specs. To provide a further safety margin, periodic quality control lab tests are made at 1,000 volts. Remember, these are low voltage devices.

The Switchcraft jack panel in Fig. 6 is representative of phenolic units suitable for relay rack mounting.

It is the correct choice of plug and jack materials, combined with good design and careful fabrication, which assure reliability and long life.

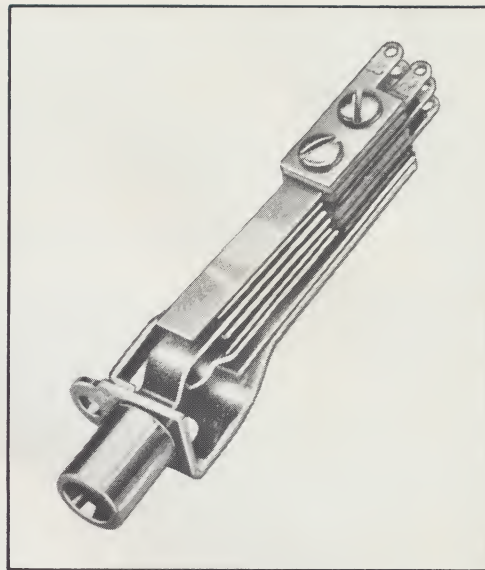


Fig. 2—Illustrated jack uses palladium leaf spring contacts to resist surface contamination. Offering long life, jacks can be used for "dry" as well as "wet" circuits.

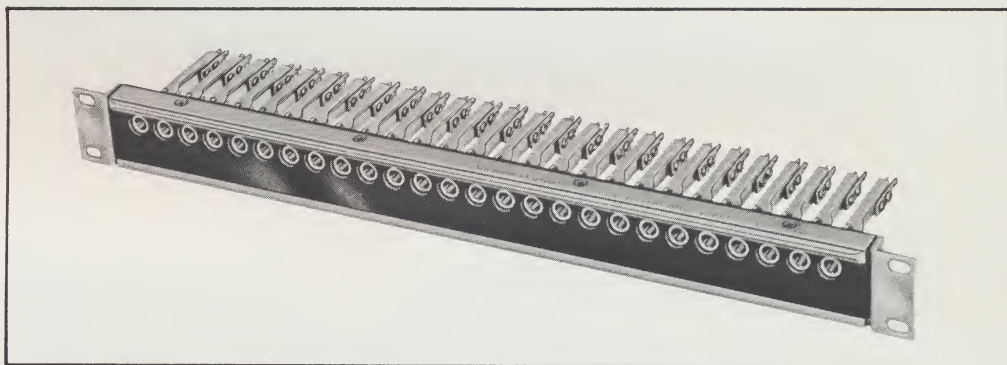


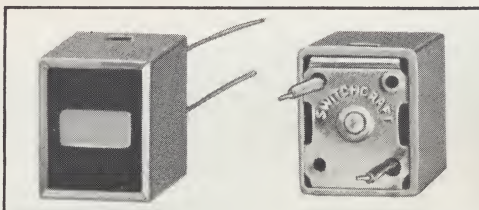
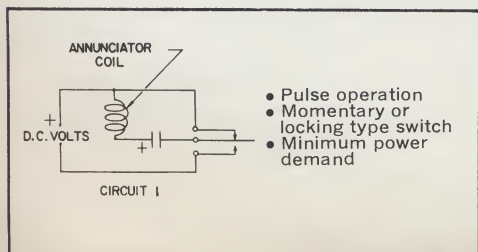
Fig. 6—Phenolic jack panel has slotted mounting brackets for standard 19" relay racks.

TAKE THE HEAT OFF YOUR CONTROL PANELS

The "Glo-Annunciator," Series GA, is a miniature, electro-magnetically operated indicating device with infinite life characteristics. Through the use of a special reflective material, it produces a highly visible color-legend display for greater operator reaction while significantly simplifying control panel design.

Due to its unique design features and flexibility of operating characteristics the "Glo-Annunciator" will meet both present and future demands of industrial and commercial equipment applications, such as: status of circuit conditions, remote machine and equipment operation, switchboard supervision, and all types of paging, call or communication systems.

Power demand of the "Glo-Annunciator" may be non-accumulative when used in the proper circuit. Series GA annunciators are ideal for use in battery operated equipment when used in a capacitor circuit.



Basic Operation

Essentially the "Glo-Annunciator" consists of a coil, an associated magnetic circuit, and a magnet indicator assembly consisting of a moving permanent magnet and two indicators which are affixed to the magnet. The magnet indicator assembly is maintained in either of two positions, each of which presents a prescribed indication to the annunciator screen.

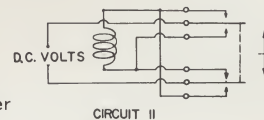
Indicator transfer from one position to the other is accomplished by applying D.C. voltage, of specific polarity, to the coil. This results in induced poles in the magnetic circuit of such direction as to force the magnet to the opposite position. Once transferred, the coil current may be discontinued leaving the indicator in its transferred position. The indicator may be returned to the initial position upon application of power of reverse polarity.

For additional information on the new GA, Glo-Annunciator, request Engineering Bulletin E-539.

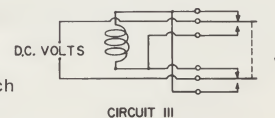
Flexibility of Operation

Circuits II, III and VI suggest various switching modes for annunciator control. Circuits II and III are applicable to single switch operation. Circuit VI illustrates the control of an annunciator from two switching stations.

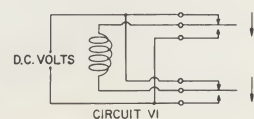
- Intermittent operation
- Three position, DPDT, momentary switch (center off)
- Intermediate power demand



- Continuous operation
- Two position, momentary or locking type switch
- Maximum power demand



- Intermittent operation
- 2, two position, SPDT, momentary type switches
- Intermediate power demand



HONEYWELL COMPUTER USES COMPACT SWITCH UNITS ON MOVABLE CONTROL CONSOLE

The already highly developed state-of-the-art of computer design was given a significant boost recently with the introduction of a fast, low-cost computer for real-time and control applications. Among its many features is a movable control console which utilizes two types of Switchcraft switches in the console's compact, but very efficient, control panel.

The new 16-bit machine is a product of the Computer Control Division of Honeywell, Inc.

Called the μ -COMP DDP-516, the 960-nanosecond machine is a third generation computer using integrated circuit logic modules. According to Honeywell, the new computer provides the performance, power and reliability of an integrated-circuit machine at less than discrete-component prices.

The DDP-516 features fully parallel organization, indexing, multi-level indirect addressing, powerful I/O system, and a 72-command instruction repertoire including byte manipulation capability. Memory capacity is 4,096 words expandable to 32,768 words; cycle time is 960 nsec.

The 16-bit word format allows a simple, efficient addressing scheme whereby 1,024 words can be addressed by a single command. Most operations can be performed in 1.92 μ secs. Of particular interest to users, the 16-bit format is directly compatible with ASCII 8-bit character codes.

Compact mechanical packaging allows the DDP-516 to be housed in a 24" x 24" x 38" cabinet. The mainframe consists of three vertical leaves containing the system power supply, central processor (with ample space for options), and the memory, expandable to 32,768 words; 16,384 in the standard cabinet. Tilt out construction provides easy access to both modules and interwiring. The entire computer may be mounted in a standard 19" rack.

The movable control console is designed to allow complete operator freedom and contains binary displays in octal representation and all operator controls. The Switchcraft units used in the console include one six-station assembly of Series 37000 illuminated "Multi-Switch" pushbutton switches, as well as two banks of four each, Series 28000 "Lev-R" switches.

By depressing the appropriate "Multi-Switch" pushbutton, the operator can display contents of the A register, B register, index register, program counter, and memory information register as well as internal counters and flip-flop status.

Control functions served by four of the eight "Lev-R" switches include selection of memory accesses. The other switches of this type on the console are four sense switches for control of programs.

The use of "Lev-R" switches in this application typifies their adaptability to situations where space is limited. This small lever switch requires less than half the space usually needed for a switch providing the same multiple circuitry. Its new, small, contoured top and bottom knob offer positive operator control, as well as a modern design to enhance the appearance of any control panel.

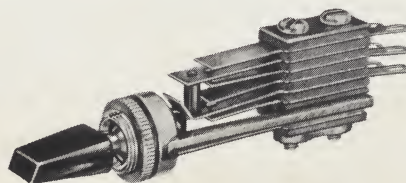
All of these same advantages are inherent in the unique design of the Series 37000 little "Multi-Switch" units utilized on the highly efficient control console of the DDP-516.

For complete specifications on the Series 28000 "Lev-R" switches, request Catalog No. S-309; for Series 37000 "Multi-Switch" information, request Catalog No. S-323.



New μ -COMP DDP-516 computer introduced by Honeywell, Computer Control Division, features compact mechanical packaging, expanded general purpose capability in a 16-bit I/C configuration. Compact control console is completely movable for freedom of operation. Six-station Series 37000 "Multi-Switch" assembly is located in center of control panel. Four lever switches located on each side of "Multi-Switch" assembly are Series 28000 "Lev-R" switches.

Close-up of typical "Lev-R" switch Series 28000 used in efficient control console of DDP-516 Computer. Note molded nylon roller designed to assure smooth, easy lever operation over entire life of switch—also greatly increases switch life. This switch mounts on 5/8" centers and requires only one 15/32" dia. mounting hole for bushing and one 1/8" dia. hole for non-turn device; depth behind panel is only 2-1/4".

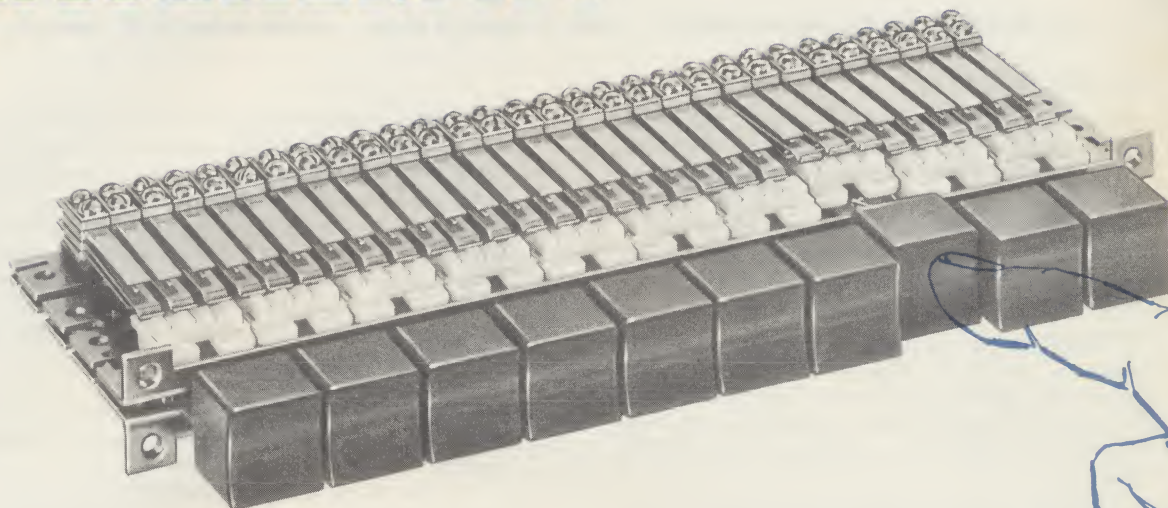


NEW

SWITCHCRAFT[®] INC.



ENGINEERING BULLETIN E-520



littel "Multi-Switch"

6 POLES OF SWITCHING IN LESS THAN 1 SQUARE INCH

Now you get Switchcraft reliability in an amazing compact, versatile, low-cost multiple station push-button switch. The littel "Multi-Switch" Series 35000 frame is so small you actually get 6PDT switching in a space less than 1 square inch. In addition, its rectangular, narrow silhouette permits stacking in tight parallel rows—control panels can be compressed by as much as 20% in size.

The Switchcraft littel "Multi-Switch" opens new dimensions of packaging for today's modern electronic equipment. It is ideal for all types of panel applications, military, industrial and commercial.

STANDARD FUNCTIONS:

MANY DIFFERENT SWITCH OPERATIONS OFFERED

Interlock—actuating a button automatically restores to normal the button previously actuated. Lock-Out feature, which prevents the operation of more than one button at a time, is standard on all Interlock switch frames.

Non-Lock—each button has momentary action. No interaction between buttons. Lock-Out available on special order only with Non-lock function.

All-Lock—all buttons, except release, lock when depressed (accumulative lock). All buttons restored

to normal by actuating release button which has momentary action.

Push-to-Lock, Push-to-Release—the button locks when depressed and is released when again depressed.

STANDARD ASSEMBLIES:

Standard frames are available, with any of the above mentioned functions, in a single row assembly of 2 to 18 stations. Plunger travel is only $\frac{3}{16}$ " on all functions except "Push-to-Lock, Push-to-Release," which is $\frac{1}{4}$ ". Plungers mount on $\frac{5}{16}$ " centers, in panels up to $\frac{3}{16}$ " thick. Standard length of plunger is $1\frac{1}{2}$ ".

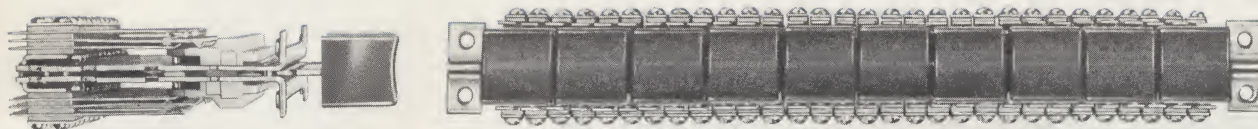
LOCK-OUT

Lock-Out feature is standard on all Interlock frames and is available on special order on Non-lock frames. The Lock-Out allows only one button at a time to be depressed.

More detailed specifications on Page 2 of this bulletin. If you would like more sales information on the new littel "Multi-Switch," Series 35000, call or write your local Switchcraft Representative or Industrial Distributor.

For Details Contact:

littel "Multi-Switch" Series 35000



... only 2-5/16" depth behind panel ... only 1" (max.) high ... buttons on 5/8" centers

DESIGN FEATURES

COMPACT DESIGN—Small, compact size with narrow silhouette saves panel space—the littel "Multi-Switch" takes less than 1 square inch of panel space per button, only 2 5/16" depth behind panel. Despite its small size, the littel "Multi-Switch," has a rugged dependability and precise switching action previously associated with much larger and more expensive switches.

SWITCHING—Series 35000 uses the new "Tini-Stack," a miniature stack switch utilizing special nickel-silver springs. Up to six "TINI-STACK" can be mounted at each station, providing for a minimum of 1-A (SPST) to a maximum of 6-C (6PDT) per button.

CONTACTS—Cross bar welded silver contacts, rated at 3 amperes, 300 watts, max., A.C., non-inductive load are standard. Palladium contacts recommended for low level circuits are available on special order.

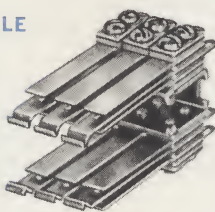
CONSTRUCTION—Uses fewer parts. Frames are stamped from precision dies, internally keyed for correct alignment to assure smooth action throughout entire life of the switch. Quality, molded nylon lifters are used at each station for easier action and longer switch life. New "Roller Action" which replaces conventional latch-bar, utilizes the mass displacement principle to achieve positive locking action—eliminates accidental station release due to shock or vibration.

PLUNGERS—Made from .050" x .187" steel, will accept standard push-on-buttons. Plunger lengths available from 1/4" and up. Standard length is 1 7/32".

MOUNTING—The entire littel "Multi-Switch" frame, from 2 to 18 stations, mounts with only four No. 6-32 machine screws (not furnished with switch). A slot in the mounting panel is also required. Width of slot must be large enough for adequate clearance of the plungers (.050"); length of slot depends upon the number of stations on the frame. See drawing for mounting dimensions.

REMOVABLE STACK MODULE

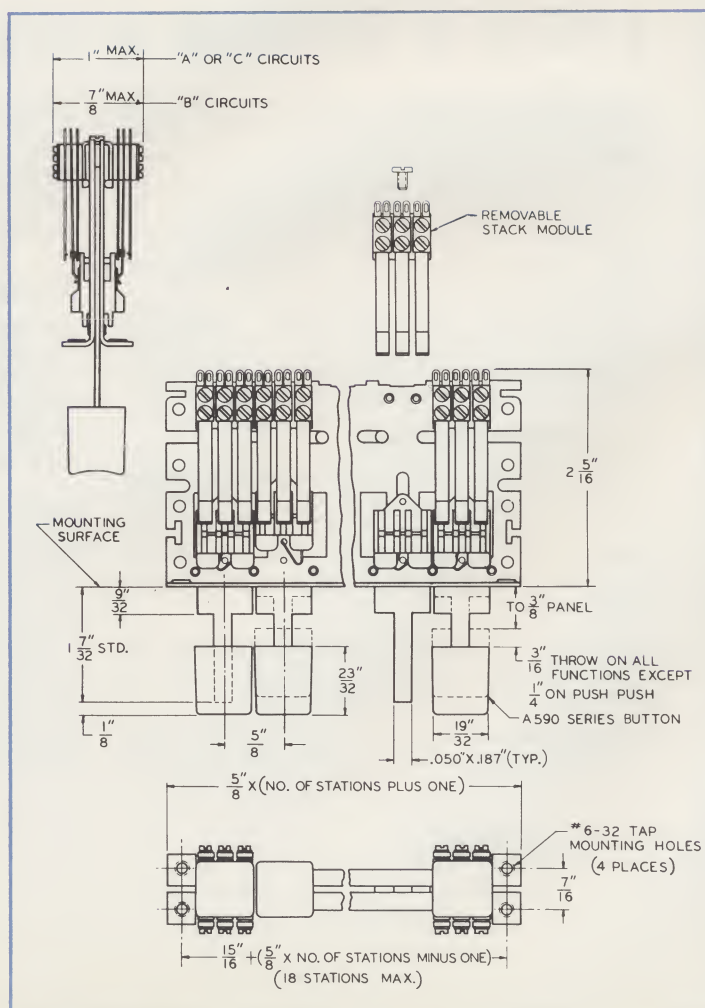
Switch stacks can be quickly and easily replaced without disturbing mounting or wiring of other stacks. Each stack module accommodates up to 6 stack switches. An entire module can be changed by removing a single screw.



BUTTONS—Modern square buttons, Series No. A-590, feature Switchcraft's patented "push-on" design that permits use on vertically or horizontally mounted switches. The buttons have a large contoured face to provide a greater area for engraving legends or symbols and for a more positive "feel" in operation. A wide choice of colors are available, such as: Red, Black, White and Brown. Other colors on special order. (For dimensional drawings of Series A-590, refer to Bulletin 127.)

ORDERING INFORMATION—Your initial inquiry should specify certain information to expedite engineering specifications such as:

1. Number of stations required.
2. Function.
3. Switching needed on each station.
4. Contacts, consider current and voltage.
5. Push-buttons, engraving, color.



SWITCHCRAFT, INC.

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